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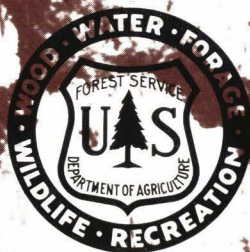
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Following Pine Looper Defoliation
on the Ashland District,
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U. S. DEPARTMENT OF AGRICULTURE-FOREST SERVICE
DIVISION OF STATE AND PRIVATE FORESTRY
NORTHERN REGION - MISSOULA, MONTANA

EVALUATION OF AN ENGRAVER BEETLE, IPS CALLIGRAPHUS
(GERMAR), FOLLOWING PINE LOOPER DEFOLIATION
ON THE ASHLAND DISTRICT, CUSTER NATIONAL FOREST, MONTANA

By

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ABSTRACT

Massive infestations of the six-spined engraver beetle, Ips calligraphus (Germar), developed in ponderosa pine stands heavily defoliated by the pine looper, Phaeoura mexicanaria (Grote), and damaged by heavy snow on the Ashland District of the Custer National Forest. A ground survey revealed that 73.3 trees per acre were attacked by Ips. Most attacks were restricted to heavily defoliated trees.

INTRODUCTION

Pines existing in a weakened or disturbed condition are recognized as being more susceptible to attack by engraver beetles than healthy trees. A study by Tunnock et al. (1968)^{1/} showed "that 90 of 100 groups of trees attacked by Ips pini (Say) were subjected to at least one type of disturbance." Though defoliated trees are considered weakened, there are few documented cases where engraver beetle populations have built up following defoliation. This report documents an instance and evaluates the existing problem.

Toward the end of April 1969, a heavy snowstorm caused extensive damage throughout the Ashland District, Custer National Forest, Montana, and the Northern Cheyenne Indian Reservation. Trees were uprooted, bent over, and tops broken off. In some portions of the Ashland District over 25 percent of the stand suffered injury.

During the summer of 1969 a looper, Phaeoura mexicanaria (Grote), severely defoliated several thousand acres of ponderosa pine on the Northern Cheyenne Indian Reservation and the Ashland District, Custer

^{1/} Tunnock, Scott, Jerald E. Dewey, and Richard A. McEwan. Examination of ponderosa pine stands attacked by pine engraver beetles in western Montana and northern Idaho during 1966. Unpubl. report, 4 pp., USDA Forest Service, January 1968.

Cover: Ips calligraphus gallery pattern.

National Forest, Montana (Dewey, 1970)^{2/}. The looper infestation spread and intensified in 1970. Defoliation varied from light to complete denuding of the trees. All size and age classes were defoliated (fig. 1.).



Figure 1.--Looper defoliated trees

By mid-October 1969, bark beetle infested trees were evident and the possibility of a widespread bark beetle problem became apparent. The beetle was identified as the six-spined engraver, Ips calligraphus (Germar) (fig. 2). This species was reported occurring in the Northern Region one other time; during 1961 and 1962 it caused tree mortality in approximately the same area. That outbreak also followed extensive winter damage.^{3/}

^{2/} Dewey, Jerald E. A pine looper, Phaeoura mexicanaria (Grote), outbreak in eastern Montana. Unpublished report, 7 pp., USDA Forest Serv., March 1970.

^{3/} Tunnock, Scott. Personal communications, 1970.



Figure 2.--Ips calligraphus adult

As summer progressed additional reports of beetle activity in the severely defoliated areas were received. During August 1970, Bureau of Indian Affairs personnel conducted a survey and reconnaissance of bark beetle damage in most of the defoliated areas on the Reservation. This was to ascertain areas to log for tree salvage and beetle removal. At this time 1,308 acres were mapped with epidemic engraver beetle conditions. Over 44,000 trees were infested. Volume estimating and tree marking were initiated to prepare infested areas for logging. During September beetle attacks were detected which occurred after the August 24 survey, and additional areas with beetle infested trees were located which had previously gone undetected. By the end of November 1970, an additional 110 acres of beetle infested trees were located plus several other small spots.

During the first week of November 1970, a survey was conducted on the Cook Mountain area of the Ashland District, Custer NF. This was the most severely defoliated area on National Forest land. The objectives of the survey were:

1. Estimate total number and d.b.h. of beetle killed trees.
2. Determine if a relationship exists between defoliation classes and Ips attacks.
3. Predict next year's beetle activity.

METHODS

A variable plot basal area cruise, using an angle gauge with a basal area factor of 10, was conducted during the week of November 2-6, 1970. Plots were located at 5-chain intervals on lines 20 chains apart. At each plot, trees were categorized by degree of defoliation as negligible, partial, and severe; and with or without Ips attack.

Trees rated as having negligible defoliation had green crowns and no noticeable defoliation. Those classed as partially defoliated exhibited partial reddening and/or thinning of foliage. Trees rated "heavy" had entirely red crowns or foliage completely removed. Trees classified "with Ips" were trees where beetles had made a successful attack. No attempt was made to distinguish between 1969 beetle attacked trees and 1970 attacked trees.

Tree diameter at breast height and total tree height were also recorded for each tree examined.

Data from the survey was analyzed by computer using a modified Region 1 timber cruise program.

RESULTS

The coniferous stand on Cook Mountain is composed entirely of ponderosa pine. The area surveyed was restricted to approximately 2,000 acres of visibly defoliated forest. The cruise gave a stand density of 229 trees per acre. Age class ranges from seedlings to trees nearly 300 years old. Diameter at breast height of the trees measured ranged from 2 to 29 inches, with a tree height range of 15 to 80 feet.

The survey data projected the total number of plus 2-inch diameter trees in the surveyed area as 440,184. Of these 140,649 (32 percent) are infested with bark beetles. This is an average of 73.3 infested trees per acre (table 1).

Volume was measured in cubic feet rather than board feet because trees with diameters less than 5 inches were recorded in the survey. Cubic volume for the area averaged 1,213.18 feet per acre. Volume infested with beetles averaged 488.85 cubic feet per acre, representing 40.3 percent of the total stand by volume. The estimated total volume of beetle infested trees is 938,582 cubic feet for the area. Over 92 percent of this is 9-inch d.b.h. class or greater.

Table 1.--Status of Ips infestation, Cook Mountain, Ashland District, Custer NF, November 1970

Tree condition	Trees/acre	Total trees in area	Cubic volume per acre	Percent of stand (stems)	Percent of stand (volume)
<u>Ips</u> infested--partial defoliation	1.1	2,056	11.60	0.5	1.0
<u>Ips</u> infested--complete defoliation	72.2	138,593	477.25	31.5	39.3
Uninfested--negligible defoliation	4.0	7,658	43.29	1.7	3.6
Uninfested--partial defoliation	122.4	235,067	394.25	53.4	32.5
Uninfested--complete defoliation	<u>29.6</u>	<u>56,810</u>	<u>286.79</u>	<u>12.9</u>	<u>23.6</u>
Total	229.3	440,184	1,213.18	100.0	100.0

With the exception of two partially defoliated trees, all beetle attacks observed occurred in completely defoliated trees. This illustrates the attraction of the beetles to the most severely damaged trees.

Beetle infested trees ranged from 4 to 24 inches in diameter. It appeared that most of the infested trees of about 8 inches or less diameter were attacked by I. pini whereas the larger trees were attacked by I. calligraphus.

DISCUSSION

The survey conducted in November accomplished its objectives. Sampling may not have been extensive enough to give a precise estimate of injury, but it was thorough enough to illustrate that a serious bark beetle problem exists on the Ashland District.

What can be expected of this infestation in terms of longevity, aggressiveness, etc., is mostly speculation for we have so little background information to draw upon concerning Ips calligraphus in the Northern Rocky Mountains.

To date the beetles have primarily confined their activity to completely defoliated trees on National Forest land. However, reports from the Bureau of Indian Affairs indicate that this was the pattern of attack on Reservation lands until late summer when attacks were observed in partially defoliated trees and a few green trees.

The looper infestation died out, due to natural causes, by the end of the summer 1970, and the amount of defoliation anticipated for 1971 is negligible. However, a considerable number of weakened trees still remain on Cook Mountain. Of the remaining trees, 19 percent have been completely defoliated; 78.5 percent are partially defoliated; and only 2.5 percent are entirely green.

Ips calligraphus overwinters in all stages of development. Larvae, pupae, callow adults, and adults were found under the bark in November. It is not known if additional adults overwinter in the duff as do many Ips species. It is also unknown how many generations this beetle can go through in a year in this area and how much brood a single female is capable of producing. A system has not been developed to sample the beetle population and predict infestation trends. This makes it impossible to predict with certainty what level of infestation will occur next year. It does appear, however, that sufficient beetles currently exist to keep the infestation active next year.

It seems very likely that the remaining completely defoliated trees will be attacked by Ips next year along with some of the more severely

partially defoliated trees. Hopefully, the stand will "green up" this spring, increase in vigor, and become more resistant to beetle attack.

Additional ground surveys will be conducted, probably in mid-summer and fall, to follow beetle activity and assess additional damage.

RECOMMENDATIONS

The most economical approach to control that can be presently recommended is salvage of infested trees and removal of high risk trees prior to attack. Slash and cull trees should be burned to destroy residual broods. The primary objectives of such action would be to eliminate weak trees, salvage insect-killed timber, and return the stand to a healthy condition.